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$$\frac{1}{2\pi}\int_0^{2\pi}\sqrt{(1-e^2\sin^2\theta)},$$

which is the ratio of the perimeter of an ellipse, whose eccentricity is e, to the circle on its major axis ; in other words, the ratio of the perimeter of an inscribed ellipse, with the given point for a focus, to that of the given circle.

[If all *possible* chords are drawn through a point (not the center) within a circle they will not be equally dense around the point; but an indefinite number of chords, or lines, drawn at random *through* a point will be equally dense around the point, hence all values of θ, in the above solution, are, *in fact*, equally probable.

Again, perpendiculars to a chord, equally distant from each other, will not represent all *possible* chords at right angles to that chord; but if in drawing an indefinite number of chords at right angles to the chord first drawn, points be selected on the first chord (which would be likely to be done in practice) through which to draw the second random chords, these chords will be, *in fact*, equally distant from each other.

Mr. Heaton sent two solutions of this problem, corresponding, respectively to the two hypotheses here presented.—Ed.]

PROBLEMS.

221. BY PROF. ORSON PRATT, SEN., SALT LAKE CITY, UTAH.—Find the four roots of the equation,

$$x^4+px^3+\frac{7p^2}{4^2}x^2+\frac{6p^3}{4^3}x+q=0.$$

222. BY GEORGE NEWBAUER, ANSONIA, OHIO.—It is required to find four positive integral numbers, the sum of the cubes of any three of which shall be a rational cube number.

223. BY WILLIAM HOOVER, BELLEFONTAINE, OHIO.—Compare the masses of two spheres of equal radii, one of uniform density, the other increasing in density from a single point in the surface as the square of the distance measured on the diameter through that point increases.

224. BY GEO. H. HARVILL, BONNER, LA. — Two posts, each 12 feet high, stand perpendicularly, fifty feet apart, on a horizontal plane, and a rope, one end of which is fastened at the top of each post, is suspended between them so that it just touches the plane at its middle point. Required the length of the rope.

225. **By Prof. Kershner.**—What is the locus of the angles of the inscribed squares of the respective segments of a circle when the chords or bases are parallel?

226. **By Prof. Johnson.**—Find the algebraic equation whose roots are the real quantities found by giving integral values to k in

$$x = \cos \frac{2k\pi}{n},$$

n being a given integer. Also the equation whose solution is

$$x = \sin \frac{2k\pi}{n}.$$

227. **By A. S. Hathaway, Cornell Univ., Ithaca, N. Y.**—If the equation $x^n + ax^{n-1} + \ldots\ldots = 0$, whose roots are α, β, etc., be transformed into another, one of whose roots is 0, while the differences are unchanged, and then the transformed equation be divided by x; and if this process be repeated $n-1$ times, prove that the product of the differences of the roots of the original equation is equal to the product of the absolute terms of the equations thus obtained.

228. **By A. Martin., m. a.**—Integrate $dI = \log (a + \surd(x^2+b^2)dx$.

229. **By Chas. H. Kummell, Detroit, Mich.**—Evaluate

$$\int_{-\infty}^{\infty} \frac{\cos m\,x}{a+x}\,dx \text{ and } \int_{-\infty}^{\infty} \frac{\sin m\,x}{a+x}\,dx.$$

230. **By Marcus Baker, U. S. Coast Survey.**—*ABCD* is any tetrahedron. Through *A* pass a plane parallel to *BCD*, through *B* a plane parallel to *CDA*, through *C* a plane parallel to *DAB* and through *D* a plane parallel to *ABC*. A new tetrahedron is thus formed the volume of which call V'. Also let V equal the volume of the original tetrahedron.

Prove that $V' = 27\,V$.

ERRATA.

On page 127, line 8 from bottom, for “to *D*”, read, 45 miles to *D*.
“ “ “ “ 4 “ “ for “maximum”, read, minimum.
“ “ 130, line 5, for “·3× 2(”, read, 3×—2(.
“ “ 135, first line of Table, for the imperfect figure in 2nd column, read, 9, and for the imperfect figure in 6th column, read, 7.
“ “ 140, line 10, for “$+(u_2+u_{-2})$”, read, $-(u_2+u_{-2})$.
“ “ 146, “ 12, insert, fraction, at the beginning of the line.
“ “ “ “ 13, for “$(a-1)a$”, read, $(a+1)a$.
“ “ “ “ 17, for “β”, as index of b, read, a.